Tecumseh Redevelopment LLC

January 8, 2021

Mr. Brandon Pursel
USEPA – Region 5
77 West Jackson Blvd., LU-16J
Chicago, IL 60604-3590

Re: Response to August 26, 2020 USEPA Comment Letter
April 2020 Remedial Study Report – Former Coke Plant
Tecumseh Redevelopment LLC, East Chicago, Indiana

Dear Mr. Pursel:

This letter has been prepared in response to the United States Environmental Protection Agency (USEPA) correspondence dated August 26, 2020, regarding the referenced former Coke Plant located in East Chicago, Indiana. The August 26, 2020 USEPA correspondence provided comments to Revision 1 of the *Remedial Study Report* (RSR) for the former Coke Plant that was submitted to the USEPA by ArcelorMittal[1] on April 17, 2020. The purpose of the RSR was to evaluate corrective measures for the site and recommend the corrective measure to be taken to address light non-aqueous phase liquid (LNAPL) impacts at the site. The RSR also provided the current site conditions, a Conceptual Site Model (CSM), proposed clean-up objectives, identification and screening of corrective measure technologies, evaluation of corrective measures, and recommendation and justification of the preferred corrective measure.

The USEPA comments are identified below in *italic font*, and the corresponding responses are provided below each comment and in the attached Remedial Study Report (Revision 2).

GENERAL COMMENTS

General Comment 1: *The response to comments included in the Report appear to be largely acceptable, however, the issue of groundwater discharge into surface water remains. ArcelorMittal refers to the results of modeling efforts to calculate surface water concentrations from groundwater concentrations with a dilution attenuation factor to estimate risks. The Indiana state rules pertaining to surface water quality standards do not allow for dilution regardless of the rate of mixing. For short-term cleanup goals, utilizing these factors may be an appropriate tool for designing a cleanup strategy and evaluating the technical practicability of several technologies; however, long-term goals must satisfy these requirements. This is consistent with Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action (EPA, 2004), and is necessary to understand in order to establish groundwater monitoring schedules, long-term stewardship goals and achieve the metrics identified in Environmental Indicator (EI) CA750.*

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[1] Cleveland-Cliffs Inc. announced on December 9, 2020 that it completed the acquisition of substantially all of the operations of ArcelorMittal USA including and its subsidiaries ArcelorMittal USA and Tecumseh Redevelopment LLC.

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Response: IDEM (pursuant to 327 IAC 5-2-11.4) identifies use of a default dilution factor of up to 25 percent of the design flow, where application of chronic (ecological) mixing zones are used to attain water quality standards in tributaries and connecting channels to the Great Lakes (including the IHSC). IAC regulations also provide for demonstration of alternative dilution capacity to address compliance for both chronic and acute (ecological) criteria. The use of 25 percent of the stream design flow was used as the conservative fraction of total receiving water flow available for dilution of site-related human health-based constituents discharging to flowing surface water. The following text provides a summary of the mixing zone evaluations conducted in 2015 and clarified in 2016 in response to USEPA comments, followed by USEPA approval as indicated in USEPA correspondence dated September 7, 2006.

In response to USEPA questions that were provided in a USEPA letter dated March 22, 2016, ArcelorMittal provided the following information in a letter submitted to the USEPA on May 20, 2016:

- An example reference concerning methodology to estimate groundwater-to-surface water dilution factors is provided in Michigan Department of Environmental Quality (MDEQ) Operational Memorandum No. 5, dated September 30, 2004. As indicated therein, chronic mixing zone criteria are calculated based on dilution of the maximum discharge flow of venting groundwater and the allocated low flow value of the receiving surface waters. MDEQ Operational Memorandum No. 5 further indicates that the maximum discharge rate of venting groundwater is calculated using Darcy's Law, consistent with the approach documented in the November 2015 Ramboll Expanded Screening Level Ecological Risk Assessment (SLERA).
- As indicated in the MDEQ Operational Memorandum No. 5 identified above, a mixing zone is the portion of a surface water body in which venting groundwater is mixed with receiving groundwater. Therefore, the dilution factor derivation in the Technical Memorandum is equivalent to a mixing zone derivation.
- Based on extremely low groundwater seepage rates relative to surface water flow rates, the exposure point concentration for benzene is at the breach in the sheet pile barrier. It should also be noted that, as an additional conservative assumption, the 95% Upper Confidence Limit (UCL) groundwater concentration for benzene from the nine wells that contribute discharge to the Canal was assumed to be representative of the entire 1,300 feet of former Coke Plant site Canal shoreline. Based on investigative data obtained to date, the cross-sectional area of detectable benzene concentrations in groundwater is substantially less than the entire former Coke Plant site shoreline.
- The stream design flow defined as the 7-day, 10-year low flow as specified in 327 IAC 5-2-11.4(b)(3)(A) is applied for purposes of deriving total maximum daily loads (TMDLs), waste load allocations (WLAs) in the absence of TMDLs, and preliminary WLAs. The stream design flow identified in the Ramboll SLERA was provided pursuant to a mixing zone demonstration. The estimated 7-day, 10-year low flow rate was 455 cubic feet per second (cfs), and the estimated 1-day, 10-year low flow rate was 431 cfs. The use of 25% of the stream design flow for constituent concentration comparison against chronic ecological criteria (455 cfs) would therefore result in a flow rate of 114 cfs, which could be applied as part of the groundwater-to-surface water dilution factor evaluation as discussed below (in the sixth and final bullet).

- It should further be noted, as an additional conservative assumption, the assumed hydraulic gradient within the Calumet aquifer sands was based on October 2012 and July 2013 Lake Michigan water levels (576.57 feet above mean sea level [AMSL] and 577.72 feet AMSL, respectively). As indicated in the November 2015 Ramboll *Pre-Design Work Plan*, the long-term average Lake Michigan water level was 578.77 feet MSL. More recently (on December 25, 2020), the reported Lake Michigan water level was even higher (581.07 feet MSL). As such, the actual long-term average hydraulic gradient across the former Coke Plant site is likely lower than the assumed value, which would result in a decreased groundwater discharge rate and therefore an increased dilution factor.
- The overall hydraulic conductivity of the non-breached sheet pile barrier was assumed as 10 percent of the estimated hydraulic conductivity of the site-specific Calumet aquifer sands for the purpose of estimating a conservatively low dilution factor. Based on the modeled hydraulic conductivity of the sheet pile (0.0014 feet per day), the revised estimated rate of groundwater discharge through the breached and non-breached area of the sheet pile barrier totals 15.8 gallons per minute. Based on this revised estimated rate of groundwater discharge, the estimated groundwater-to-surface water dilution factor is 4,620, using the mixing zone demonstration. Use of 25% of the stream design flow for constituent concentration comparison against chronic ecological criteria (i.e., 25% of the 7-day, 10-year low flow rate of 455 cfs) results in an estimated groundwater-to-surface water dilution factor of 3,250. Further, based on use of the stream design flow for constituent concentration comparison against acute ecological criteria (i.e., 1-day, 10-year low flow rate of 431 cfs), the estimated groundwater-to-surface water dilution factor is 12,300. In summary, regardless of the dilution factor calculation approach, the use of a dilution factor of 3,250 is acceptable and conservative.

In response to the foregoing information, the subsequent USEPA correspondence dated September 7, 2016 indicated the following:

> *Based on the original and revised analyses, use of a dilution attenuation factor of 3,250 is appropriate and conservative in representing attenuation in contaminant concentrations as groundwater beneath the site discharges into the Indiana Harbor Ship Canal in the vicinity of and through the sheet pile wall. As stated previously, the resultant concentrations should be limited to assessment of chronic ecological toxicity.*

Moreover, based on groundwater quality data obtained to date, maximum petroleum volatile organic compound (VOC) concentrations downgradient of the LNAPL source are located to the northeast of, and deeper than, the on-site sheet pile engineered gap. July 2013 and September 2017 groundwater samples from the shallow monitoring wells near the breach (MW-809S, MW-810S, MW-826S, and MW-827S) did not contain exceedances of IDEM Screening Levels for naphthalene, benzene, ethylbenzene, or toluene, with the exception of benzene in one sample on one date (the September 2017 sample from well MW-809S contained 2.2 milligrams per liter [mg/L]). The sheet pile wall therefore represents an effective physical hydraulic barrier, which restricts movement of the identified petroleum VOC-impacted groundwater to the Indiana Harbor Ship Canal.

Section 4.4.1 of the USEPA-approved September 2016 *Pre-Design Work Plan* concluded that the sheet pile wall represents an effective physical hydraulic barrier and that future LNAPL source remedial action will be conducted in conjunction with implementation of a downgradient groundwater monitoring program. Based on relatively high estimated groundwater flow rates at the site, the planned LNAPL source remedial action should result in reduction in downgradient dissolved phase concentrations within a reasonable timeframe. As indicated in the September 2016 Pre-Design Work Plan and repeated in the April 2020 Remedial Study Report (Revision 1), if Indiana Harbor Ship Canal sentinel wells MW-809S, MW-810S, MW-826S, and MW-827S indicate increasing petroleum VOC or naphthalene concentrations to levels of concern, then active groundwater remediation near the Canal will be contemplated.

General Comment 2: *The Report places emphasis on a 7-year monitoring period for the corrective measures, which ArcelorMittal believes is "a reasonable time frame that may be necessary to demonstrate stable or decreasing VOC concentrations in groundwater site- wide." EPA does not agree that placing timeframes on monitoring periods without additional metrics and measures pertaining to groundwater conditions is appropriate. Instead, EPA believes it is preferable to discuss the duration of the groundwater monitoring program in terms of contaminant concentration targets rather than a set number of years. The Report should rely on quantitative metrics and decision endpoints when determining monitoring periods or schedules. Examples of metrics may include statistical evaluations or other metrics that measures LNAPL behavior, geochemistry or physical properties. The Report should be revised to include a performance-based approach rather than a time-based approach for each technology evaluated.*

Response: The following text has been added to Section 6.1.2.5 of the revised RSR: "Because active remediation associated with each evaluated corrective measure can be completed within a relatively short time frame (i.e., less than 2 years), a 7-year duration of groundwater monitoring is assumed for each corrective measure for the sake of consistency in terms of comparing overall remediation costs. For the corrective measures that include active remediation, the assumed duration of remedial performance groundwater monitoring includes 2 years of quarterly monitoring (starting with commencement of remediation), followed by 2 years of semi-annual monitoring, followed by 3 years of annual monitoring. It is understood that a performance-based approach where groundwater monitoring data is used to evaluate the occurrence of NSZD or NA will be used to determine actual monitoring time frames. This performance based approach will be provided in a Long-Term Monitoring plan to be included as part of a forthcoming Corrective Measures Implementation Work Plan."

General Comment 3: *Groundwater monitoring is expected to be a component for each technology that was evaluated, and the Report states that monitoring will begin following the completion of each active remedy's implementation. Considering that time frames vary with each active remedy, the Report should include additional detail on when the monitoring period would begin with each technology. The cost tables should reflect this information as well in the event this revision causes the overall estimate to change.*

Response: The following text has been added to Section 6.1.2.5 of the revised RSR, "For the corrective measures that include active remediation, the assumed duration of remedial performance groundwater monitoring includes 2 years of quarterly monitoring (starting with commencement of remediation), followed by 2 years of semi-annual monitoring, followed by 3 years of annual monitoring." The cost tables in Appendix B, Table B-1 to Table B-3 have been updated accordingly.

General Comment 4: *The Report contains inconsistencies regarding the balancing and threshold criteria, namely how they are used in evaluating each technology and how much weight was given to each criterion for the applicable technology. The comparative analysis summarized in Section 7 and Table 7-1 should be revised to ensure each technology is evaluated evenly against the threshold and balancing criteria. Presently, it would appear the analysis was performed with a bias in favor surfactant enhanced recovery (SER).*

Response: Responses to General Comment 4 regarding Section 7 and Table 7-1 are included under the responses to Specific Comments 6 through 11 below.

General Comment 5: *The Report should include draft institutional control language to facilitate expedited implementation of groundwater use restrictions and deed restrictions.*

Response: Submittal of specific language regarding future land use restrictions is premature prior to USEPA approval of a remedial path forward for the former Coke Plant. As part of future land use restrictions, Tecumseh Redevelopment LLC intends to include provisions for groundwater use restrictions and worker protections should intrusive activity take place at the former Coke Plant.

General Comment 6: *EPA reiterates the need for an adaptive approach to remedy implementation, that is, recognizing the need for additional treatment options should asymptotic conditions arise prior to corrective measures objectives (CMOs) being met within the point of compliance. EPA acknowledges the confidence expressed by ArcelorMittal regarding the likelihood of success with SER at the former Coke Plant as well as the possible need for additional remediation should sentinel wells along the Indiana Harbor Shipping Canal indicate a need. EPA may also request additional measures be taken if wells within the greater area of contamination do not suggest CMOs or other threshold criteria will be met with SER alone.*

Response: Comment acknowledged. The following text has been added to Section 7: "If Indiana Harbor Ship Canal sentinel wells MW-809S, MW-810S, MW-826S, and MW-827S indicate increasing petroleum VOC or naphthalene concentrations to levels of concern, then active groundwater remediation near the Canal will be contemplated."

SPECIFIC COMMENTS

Specific Comment 1 (Section 2.5.3, 2013 LNAPL Sample Results, Page 15): *A list of contaminants of concern was provided that includes arsenic but differentiates background concentrations and site activity. The Report notes that higher concentrations in the deeper zones are attributable to reducing conditions but makes little mention of concentrations in the shallower depths. Expand this section to discuss if shallow groundwater concentrations can be attributed to background concentrations or site activity. Additionally, expand this section to reflect that arsenic was carried over into risk assessments and in the Report and clarify if those concentrations reflect shallow or deeper zones.*

Response: Section 2.5.3 of the Report has been expanded/revised to include further discussion of arsenic. As discussed in Section 2.5.3, arsenic has been screened out as a contaminant of concern based on the human health and ecological risk assessments.

Specific Comment 2 (Section 5.3, Technology 1 – Hydraulic Containment, Page 24): *The Report says hydraulic containment will be used; however, containment usually is used to describe enclosures or some other technique to keep contamination migrating in an uncontrolled manner from a defined source area. Considering the approach relies on extraction of groundwater, the Report should be revised in this section and elsewhere to reflect this.*

Response: Section 5.3 of the revised text has been modified to indicate that hydraulic extraction is retained as a component of other remedial technologies that alter the chemical or physical nature of the LNAPL.

Specific Comment 3 (Section 6.1.2.5, Cost, Page 29): *The Report states in Section 4, page 23 under the Corrective Measures Objectives section that financial assurance will be used to ensure future obligations, including operations and maintenance of active remedies and other mechanisms, can continue. The Section 6.1.2.5 should be expanded to state what mechanism(s) are being considered for financial assurance.*

Response: Mechanisms being considered for financial assurance will be submitted in a separate correspondence.

Specific Comment 4 (Section 6.1.2.5, Cost, Page 29): *This section discusses groundwater monitoring as a common component of all active corrective measures technologies; however, the text suggests it serves as a distinct and separate technology. Revise this section to reflect the role that groundwater monitoring will play during and after remedy implementation.*

Response: The following text has been added to Section 6.1.2.5: "For the corrective measures that include active remediation, the assumed duration of remedial performance groundwater monitoring includes 2 years of quarterly monitoring (starting with commencement of remediation), followed by 2 years of semi-annual monitoring, followed by 3 years of annual monitoring."

Specific Comment 5 (Sections 6.2 through 6.4): *This section appears to be largely focused on LNAPL source zone treatment, whereas each technology will likely have an effect on soil contamination, dissolved-phase groundwater contamination and source mass. These sections should include each technology's ability to address contaminants in these media, while also noting the risks of enhanced mobility with a potential effect of increasing the contamination footprint.*

Response: Revised Sections 6.2 through 6.4 provide discussions of each technology's ability to address soil contamination, dissolved-phase groundwater contamination and source mass, and also note the risks of enhanced mobility in terms of the potential effect of increasing the contamination footprint.

Specific Comment 6 (Section 7): *Section 7 discusses drawbacks regarding factors that apply to in-situ chemical oxidation (ISCO), but not SER despite these factors being important for both technologies. In particular, good contact between the surfactant or oxidant and the LNAPL or residual LNAPL is necessary for both technologies and in both cases is facilitated by favorable permeability and homogeneity in the subsurface. Despite these factors being relevant for both SER and ISCO, this section states that low permeability matrices and oxidation being limited to* *the surface of the NAPL is only a drawback for ISCO. It is unclear why the factors would not be a drawback for both technologies.*

Response: Section 7 of the previous (April 2020) text did indicate that "Surfactant enhanced recovery can represent an effective technology for treatment of LNAPL source zones, if good contact between the surfactant and residual LNAPL is achieved." The following information has been added to Section 7 of the revised text:

> As with most *in-situ* technologies that involve subsurface delivery and recovery of active ingredients, surfactant flushing is most amenable to relatively homogenous subsurface systems with sufficient permeability to allow the injected fluid to be delivered and recovered efficiently. Contaminant sorption and/or formation of NAPL limits the availability of hydrophobic organic chemicals (HOCs) for in-situ remediation. HOCs are therefore less chemically available for chemical oxidation treatment. A key challenge for injection and/or extraction of remediation reagents is "pathway interference" caused by sorption coupled with interfacial tension (IFT). IFT occurs between water and oil phases, when contaminant concentrations approach or exceed NAPL formation. Therefore, when groundwater makes contact with NAPL that has filled the cross-sectional area of a pore space, IFT prevents migration of groundwater and NAPL through the contact barrier that separates these two phases such that groundwater will flow in alternate pathways. Consequently, the sorbed and NAPL phases become isolated from contact during *in-situ* remediation. Left untreated, these isolated sorbed and NAPL masses serve as sources for localized mass flux, resulting in back diffusion which hinders efforts to achieve remediation objectives.
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> In addition to their tendency to accumulate at interfaces, surfactants have the ability to self-aggregate, to form micelles above a specific concentration, referred to as the critical micelle concentration (CMC). When the surfactant concentration approaches the CMC, the surfactant monomers begin to aggregate to form micelles, consisting of a hydrophobic core surrounded by a hydrophilic shell. Here, the shell stabilizes the surfactant micelle in the aqueous solution, providing a nonpolar core into which hydrophobic (nonpolar) organic compounds can readily partition.
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> One applicable surfactant (Ivey-sol®) is a non-ionic and biodegradable product that functions below the CMC, when selectively desorbing sorbed contaminants from soil surfaces or liberating NAPL ganglia to the aqueous phase. Because this surfactant product does not emulsify the contaminants of concern, the extracted groundwater, laden with desorbed contaminant mass, can be processed through conventional oil/water separators. Secondary wastewater treatment can then be conducted via granular activated carbon, membrane separation, bioreactors, air strippers or other technologies prior to regulated discharge. A summary comparison of application factors for ISCO and SER is provided as follows:

Application Factors	ISCO	SER (Ivey-sol)
Requires contaminant contact	Yes	Yes
Surface tension	>70 Dynes	<30 Dynes
Reacts with geology	Yes	No
Dosage	Moderate to High	≤ 2% (Or lower)

Application Factors	ISCO	SER (Ivey-sol)
Effective with carbon 6 to carbon 50 molecular weights	No	Yes
Health & Safety	Significant precautions	Minimal
Removed after injected	No	Yes
May kill indigenous bacteria	Yes	No
Easy to inject in fine grained sediments	No (Has high surface tension)	Yes (Has low surface Tension)
Chemical crusting (oxidation) reduces effective porosity	Yes	No
Cost effective in treating LNAPL	No	Yes
Caustic or corrosive	Yes	No
Will hinder MNA	Potentially	No
Post treatment exceedances of metals and pH	Potentially	No
Can enhance other physical, biological and chemical remediation methods	Potentially	Yes
Affect geotechnical soil quality	Potentially	No
Biodegradable	No	Yes
Impurity and PFAS Free	Unknown	Yes

Specific Comment 7 (Section 7): *This section states that in-situ thermal reduction (ISTR) will not likely remove all contaminant mass, leaving a small fraction in the subsurface after treatment. While the goal of all remedies is to remove all contamination so that soil and groundwater is completely restored to its maximum beneficial use, it is understood that active remedies will likely leave some mass untreated regardless of the technology, especially in scenarios where contaminant concentrations are significantly above all local, state or federal criteria. The Report does not provide an estimated percent mass removal for SER and ISCO, although it is believed those technologies are also likely to leave some fraction of contaminant mass behind following treatment. The Report estimates that more than 99% of the contaminant mass may be removed with ISTR, suggesting this technology could be highly ranked depending on how much mass removal is expected with ISCO or SER. The discussion should be expanded to include a more balanced evaluation of the expected performance of each technology.*

Response: *The following text* has been added to the first paragraph in Section 7: “As indicated in McGuire et al. (2016), median reductions in the geometric means of parent compound concentrations in treatment zones have been reported as 77 percent for ISCO, 87 percent for SER, and 98 percent for ISTR when compared with monitored natural attenuation. It should be noted that these median reductions are subject to wide variation based on site-specific hydrogeologic and contaminant conditions.”

Specific Comment 8 (Section 7): *The section notes the costs for each technology is high; however, there is no justification for stating the cheapest option is also high in the context of cost comparisons. Furthermore, each estimate is well within an order of magnitude from one another, suggesting that cost differences do not vary substantially. For these reasons, cost differences should not play a significant role in remedy selection compared to the other balancing criteria.*

Response: Estimated costs to implement each of the potential corrective measures are as follows:

- Surfactant-enhanced recovery: $3,545,000
- *In-situ* thermal remediation: $5,440,000
- *In-situ* chemical oxidation: $7,252,000

The text and Table 7-1 have been revised to indicate that costs associated with surfactant-enhanced recovery are moderate, costs associated with in-situ thermal remediation are high, and costs associated with in-situ chemical oxidation are very high. Estimated costs associated with in-situ chemical oxidation are $3,707,000 higher than costs associated with surfactant-enhanced recovery. It can therefore be reasonably concluded that cost differences are an important factor in remedy selection when compared with other balancing criteria.

Specific Comment 9 (Section 7): *This section largely overlooks Table 7-1, that is, benefits and detriments associated with each technology are not consistently discussed. For example, both ISCO and ISTR can treat LNAPL and dissolved-phase constituents; however, this section does not draw attention to this benefit for both technologies. This is material considering that SER intentionally increases the mobility of LNAPL and dissolved-phase VOCs to facilitate extraction. Additionally, Table 7-1 notes that ex-situ treatment is necessary for ISTR making the technology not favorable; however, SER also requires ex-situ treatment or disposal whereas ISCO does not. Finally, both this section and Table 7-1 should reflect the necessity for multiple injections with ISCO and SER, as well as the longer time period needed for ISTR to reach maximum efficacy. This section and Table 7-1 should be expanded to include these comparisons and more accurately reflect one another so they evaluation is balanced.*

Response: The following text has been added after the first paragraph in Section 7: "With respect to the dissolved phase, ISCO and ISTR technologies are capable of more aggressive treatment of dissolved phase constituents than surfactant enhanced extraction. However, the following factors should be noted:

- Surfactant enhanced application processes liberate LNAPL and sorbed contaminants, such that they become more miscible and therefore more available for microbial and associated enzymatic degradation.
- None of the three evaluated corrective measure alternatives involve active remediation of the dissolved phase beyond the LNAPL footprint. However, removal of LNAPL mass via all three corrective measure alternatives should result in a reduction in benzene concentrations outside the LNAPL footprint over time.

- Based on relatively high estimated groundwater flow rates at the site, LNAPL source remediation should result in reduction in downgradient dissolved phase concentrations within reasonable timeframes.
- If Indiana Harbor Ship Canal sentinel wells MW-809S, MW-810S, MW-826S, and MW-827S indicate increasing petroleum VOC or naphthalene concentrations to levels of concern, then active groundwater remediation near the Canal will be contemplated."

Although existing Table 7-1 notes that ex-situ treatment is a component of ISTR, Table 7-1 does not conclude that ISTR is not favorable on that basis. *Ex-situ* treatment associated with ISTR typically involves construction of an on-site treatment system whereas recovered fluids from surfactant enhanced extraction events are typically transported for off-site treatment via vacuum truck. Table 7-1 has been updated to indicate that injection and extraction of surfactant solution is followed by *ex-situ* treatment, and also that ISCO and SER require multiple injection events.

The following text has been added to the first paragraph in Section 7: "With respect to duration of remediation, LNAPL removal via ISTR can be completed within approximately 4 to 6 months of commencement of remedial system operations. LNAPL removal via ISCO and SER typically require multiple injection events over a 1 to 2-year timeframe." Table 7-1 has also been updated to include this information.

Specific Comment 10 (Section 7.1): *Green remediation is discussed as a benefit for SER, however, does not appear to have been a factor in evaluating the other technologies. This section and Table 7-1 should up be expanded to include this factor in the implementability row.*

Response: Table 7-1 has been updated to include this factor in the implementability row, and the following text has been added to the second paragraph in Section 7.1: "In terms of green remediation, the following factors should be noted:

- The surfactant-enhanced recovery alternative would include an estimated 39 injection locations and injection/extraction of 10,400 gallons of surfactant solution for each of an assumed six surfactant-enhanced LNAPL recovery events.
- The ISCO alternative would include an estimated 64 injection locations and injection of 94,000 gallons of oxidant solution for each of an assumed six oxidant injection events. Each ISCO injection event would include an estimated 276,000 pounds of oxidant.
- The ISTR alternative would include an estimated 52 SEE injectors, 15 extraction wells, and 25 temperature sensors. The estimated energy required to heat the subsurface as part of the ISTR alternative totals 7,044,000 kilowatt-hours."

Specific Comment 11 (Section 7.3): *Community acceptance of SER is noted as an important factor due to its implementation not resulting in off-site impacts, additional traffic, or other impacts to workers or the community. These benefits are also applicable to ISTR and ISCO as well, therefore this does not appear to be a distinguishing factor over the other technologies.*

Response: The last three sentences of Section 7.3 have been revised as follows: "The ISTR, ISCO, surfactant-enhanced recovery and institutional control remedies would be expected to be accepted by the community for several reasons. First, the remedies would predominately involve on-site activity with little additional traffic and no off-site impacts. Second, the remedies would shorten the duration of time required for removal of LNAPL, and third, the remedies would not present any risks to on-site workers or the community."

Specific Comment 12 (Table 4-1): *This table appears to be intended for discussion pertaining to CMOs and performance metrics, however, is limited only to SER. In order to support a final decision, this table should also include ISCO and ISTR's ability to meet CMOs with relevant metrics associated with each technology. Presently, this table is not useful for evaluating the technical practicability of each technology. The table title should also be revised to reflect performance metrics without a reference to any one particular technology.*

Response: Table 4-1 has been revised to include discussions of ISCO and ISTR's ability to meet CMOs, with relevant metrics associated with each technology.

Specific Comment 13 (Appendix B: Costs): *The cost estimate should include a more detailed estimate regarding assumptions that were made in estimating the costs for each technology. Examples include but are not limited to the number of extraction wells, volume or mass of surfactant or oxidants and total solution to be injected, quantity of temperature sensors and number of heating events, and the estimated time frame to completion. There are also line items that would be applicable to each technology but are only used to estimate one technology. For example, injection management and injection well abandonment would be a common element for SER and ISCO; however, only ISCO includes this line item. Treatment and disposal of extracted materials should also be included in the cost estimates. Generally, the level of detail should be consistent across each technology so an accurate cost comparison can be made.*

Response: Existing Tables B-1, B-2 and B-3 include costs for treatment and disposal of extracted materials. A line item has been added to revised Table B-1 that indicates an estimated cost for well abandonment. Based on an August 2020 telephone communication with the USEPA, it is understood that additional backup and breakdown of the estimated corrective measure costs will not be required by the USEPA.

If you have any questions regarding these responses to USEPA's comments, please contact us at your convenience.

Sincerely,

Tecumseh Redevelopment LLC

Keith Nagel
Director Environment Land & Remediation

Enclosure

cc: Cary Mathias
Jeanne Tarvin, Ramboll